Example #13: A generator at City A delivers power at 1000 kW to City B. The total resistance in the cables is only 10 ohms.

a) **How much power is lost if delivered at: 5000 V; 500 000 V.**

b) **Determine the efficiency rating for both voltages in a).**

a) Find current drawn from source:

$$P = IV$$

① $1000\,000 = I(5000)$

$$I = 200\ A$$

Now find power lost in lines:

$$P = I^2R = 200^2(10)$$

$$\boxed{P = 400\,000\ W}$$

② $1000\,000 = I(500\,000)$

$$I = 2\ A$$

$$P = I^2R = 2^2(10)$$

$$\boxed{P = 40\ W}$$

b) $\text{efficiency} = \dfrac{\text{useful power out}}{\text{power in}} \times 100$

$$= \frac{1000\,000 - 400\,000}{1000\,000} \times 100 = \boxed{60\%}$$

or

$$= \frac{1000000 - 40}{1000\,000} \times 100 = \boxed{99.996\%}$$